SHORELINE INVENTORY AND CHARACTERIZATION

SHORELINE MASTER PROGRAM UPDATE – WEST RICHLAND, WASHINGTON

Prepared for the
City of West Richland
Community Development Department

Prepared by
Herrera Environmental Consultants, Inc.

and

AHBL, Inc.

Note:
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Prepared for the
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October 7, 2013

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INTRODUCTION

Background and Purpose

The City of West Richland (City) is updating its Shoreline Master Program (SMP). According to Substitute Senate Bill (SSB) 6012, passed by the 2003 Washington State Legislature, cities and counties are required to amend their local SMPs consistent with the Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58, and the SMA implementing guidelines, Washington Administrative Code (WAC) 173-26.

The goal of the SMA is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." The SMA protects shoreline resources by regulating development, but is also intended to provide for appropriate shoreline use. The SMA encourages public access and use of the shoreline and provision of water-dependent uses, as well as land uses that enhance and conserve shoreline functions and values. The guidelines (WAC 173-26) establish goals and policies that provide a framework for development standards and use regulations in the shoreline. The SMP is based on state guidelines but tailored to the specific conditions and needs of individual communities. The SMP is also meant to be a comprehensive vision of how the City's shoreline area will be managed over time.

The first phase of the City's SMP update was to identify the shoreline jurisdiction and prepare a plan for public participation in SMP update process. The second phase of the City's SMP update requires preparation of a shoreline inventory and characterization report to be used as a foundation for the SMP update process (WAC 173-26-201(3)(c) and (d)). In subsequent phases, the City will conduct restoration planning and update its shoreline management policies and regulations. This document was prepared to fulfill the requirement of the second phase and serves to accomplish the following goals:

- Inform the review of current shoreline regulations required by the update process
- Highlight areas where shoreline resources protection measures and shoreline use designations could be improved to meet shoreline management goals

To achieve these goals there are specific objectives of the City's shoreline inventory and characterization report:

- Provide supporting information for determining updated environmental designations
- Establish the baseline for no net loss of ecological conditions and inform development of protective policies, regulations, and mitigation standards
- Identify opportunities for protection of ecological resources, improving public access, and supporting water dependent uses
- Identify degraded areas and opportunities for restoration to be incorporated into a restoration plan

Scope and Organization of Shoreline Inventory and Characterization

The inventory and characterization report documents baseline shoreline conditions, and provides a basis for revising SMP goals, policies, and regulations for the City. Information provided includes existing physical conditions as well descriptions of watershed and shoreline attributes that pertain to the City's shoreline jurisdiction. In addition, existing ecosystem shoreline processes, land uses, and development patterns are characterized. Descriptions of shoreline functions, shoreline use, public access, and opportunities for restoration are also provided. The characterization will help to evaluate and guide revisions to the City's SMP goals, policies, and regulations based on existing functions and values of shoreline resources, as well as identify opportunities for conservation and restoration of ecological functions.

This report provides information on the City's shoreline ecosystems, specific discussions on individual shoreline reaches, a use analysis identifying existing uses and potential future uses, recommendations for shoreline management, and data gaps that would be helpful to close for future planning. First, the methods used for the inventory and characterization are described. Second, a general overview profiles larger scale ecosystem characteristics and processes observed in the City. These include physical constraints such as climate, topography, geology, and soils; the key processes underlying shoreline ecosystem functions; and descriptions of City land use, land cover, historical and cultural resources, public access, shoreline alterations, and key habitats and species. The general overview is followed by a reach analysis.

The reach analysis provides more detailed characterizations of physical and biological conditions within the City's shoreline reaches. These discussions cover existing land uses, future uses based on the City's comprehensive plan, shoreline modifications, historic and cultural resources, and public access potential. Included in the reach analysis are tabular data used for characterization and analysis of physical processes and ecological functions. Also included are a functional assessment, identification of potential restoration opportunities, shoreline use analysis, and shoreline management considerations to guide changes or additions to the City's existing SMP.

METHODS

Inventory Data and Information Sources

Available data were compiled and reviewed to provide background information to be used for the inventory and characterization of shorelines in the City of West Richland. Table 1 provides the geographic information system (GIS) data sets and relevant information compiled and reviewed for this report. Although not all data elements in Table 1 are included in the maps, key spatial data are provided in the Map Folio found in Appendix A.

Additional key reports and information included, but were not limited to, previous adopted shoreline jurisdiction and environmental designations, Comprehensive Plan, Capital Improvements Plan, Park and Open Space Plan, Development Code, and Critical Areas Code provided by the City, as well as numerous basin assessments and plans cited throughout this report and included in the References section. GIS mapping data for the Shoreline Inventory were collected from a variety of sources, including the City, Benton County, Washington Department of Ecology (Ecology), Washington Department of Fish and Wildlife (WDFW), Federal Emergency Management Administration (FEMA), the US Fish and Wildlife Service (USFWS), the US Geological Survey (USGS), and the National Land Cover Database. Some data associated with the City's Critical Areas Ordinance (CAO), particularly geologic hazard areas, were not available in GIS format and had to be converted or digitized for mapping, either from aerial photographs or pre-existing maps. The extent of these areas should therefore be considered approximate. The channel migration zone (CMZ) of the Yakima River was delineated by Benton County, but did not include areas in the City's jurisdiction. The approximate CMZ was therefore extrapolated for areas in the City's jurisdiction based on a review of the adjacent County CMZ delineation, topographic maps, flood zones, wetlands, and historical and current aerial imagery.

Determination of Shoreline Planning Area and Reaches

The Department of Ecology, the agency responsible for overseeing the regulation of shorelines of the state has identified the rivers, streams, lakes, and portions thereof, which constitute shorelines of the state. The criteria for rivers and streams east of the Cascade range is defined as natural rivers or segments "downstream of a point where the annual flow is measured at two hundred cubic feet per second or more, or those portions of rivers east of the crest of the Cascade range downstream from the first three hundred square miles of drainage area, whichever is longer" (RCW 90.58.030).

SMA jurisdiction includes all "shorelines of the state" as defined in RCW 90.58.030. Shorelines of the state include the total of all "shorelines" and "shorelines of statewide significance." Shorelines mean all of the water areas of the state, including reservoirs, and their associated shorelands, together with the lands underlying them, *except*:

- Shorelines on segments of streams upstream of a point where the mean annual flow is 20 cubic feet per second (cfs) or less and the wetlands associated with such upstream segments
- Shorelines on lakes less than 20 acres in size and the wetlands associated with such small lakes

Table 1. Summary of Spatial Data Sources for Inventory and Characterization.

Data	Source	Maps [a]
Current and historical aerial imagery	City (2012) US Department of Agriculture (USDA) (1996, 2003-2006, 2009, 2011)	All maps show 2012 aerial
Topography, floodway, floodplain, and channel migration zone (CMZ)	Federal Emergency Management Administration (FEMA) 1982 Q3 flood data [b], Benton County CMZ delineation (2012), US Geological Survey (USGS) topographic quadrangles	2.1, 2.2
City and Urban Growth Area (UGA) boundaries, zoning, tax parcels, right-of-ways, utilities, stormwater and sewer facilities and outfalls	City	7.1, 7.2
Comprehensive Land Use Plan: future land use designations	City	6.1, 6.2
Lakes and streams	Washington Department of Natural Resources (WDNR) State Hydrography database and USGS National Hydrography Dataset (water bodies)	1.1, 1.2
Wetlands	City, US Fish and Wildlife Service (USFWS) National Wetland Inventory, Washington Department of Ecology (Ecology)	8.1, 8.2
Water quality	Ecology 303(d) list (2012)	1.1, 1.2
Land cover and impervious surfaces	USGS National Land Cover Database (NLCD), National Oceanic and Atmospheric Administration (NOAA) 2006 update to NLCD	5.1, 5.2
Soils	Natural Resources Conservation Service (NRCS) soil survey	4.1, 4.2
Geologic and erosion hazard areas	City	3.1, 3.2
Aquifer recharge areas, wellhead protection zones, toxic and hazardous material clean-up sites	Ecology	1.1, 1.2
Shoreline modifications (docks, piers, boat ramps, levees, bank alterations)	Based on 2012 aerial imagery, Ecology (Washington State Levee Inventory)	1.1, 1.2
Priority habitat and species (PHS)	Washington Department of Fish and Wildlife (WDFW) PHS database	8.1, 8.2

[a] Maps may not include all elements from Data column.
[b] The City of West Richland Municipal Code Chapter 18.25 adopts the 1981 FEMA flood insurance rate map (FIRM). FEMA is in the process of updating FIRMs but has not completed the update for the City yet. A completion date is unknown.

The shoreline area to be regulated under the City SMP must include all shorelines of statewide significance, shorelines of the state, and their adjacent "shorelands," defined as the upland area within 200 feet of the ordinary high water mark (OHWM), as well as any "associated wetlands" (RCW 90.58.030). Associated wetlands means those wetlands that are in proximity to and either influence or are influenced by tidal waters or a lake or stream subject to the SMA (WAC 173-22-030(1)). These are wetlands that physically extend into the shoreline jurisdiction, or wetlands that are functionally related to the shoreline jurisdiction through surface water connections or other factors.

Local jurisdictions can choose to regulate development under their SMPs for all areas within the 100-year floodplain or the smaller area defined by RCW 90.58.030(2)(d). For the purposes of this report, lands extending 200 feet from the ordinary high water mark of regulated shorelines, floodways and contiguous floodplain areas landward 200 feet from such floodways, and all associated wetlands are included in the West Richland shoreline planning area (study area), and regulated under the SMP.

The City has approximately 5.91 miles of shoreline associated with the Yakima River, and 386 total acres of shorelands in its SMA planning area. In accordance with Ecology guidance, the planning area may contain a nested system of management areas and reaches. However, since all of the City's shorelines are associated with a single watershed, the lower Yakima River, it is appropriate to consider the entire City as within or containing a single management area. The management area is broken down into reaches for the purposes of this inventory and characterization.

The City was divided into two reaches listed below (Figure 1) based on areas having similar physical and ecological characteristics, land use, and development patterns.

- **Reach 1** – Yakima River, west side of the City
- **Reach 2** – Yakima River, east side of the City near West Richland Golf Course

Figure 1 illustrates the City's shoreline management area and reaches, which encompass the entire shoreline jurisdiction within the City. Reach 2 is further divided into segments, Areas 2a through 2d, to clearly illustrate those small areas in Appendix A, Map Folio. Portions of the Yakima River shoreline between the intermittent segments in Reach 2 are excluded from the study area as they are more than 200 feet from the City boundary and not within the City's shoreline jurisdiction. Although the McWhorter irrigation canal is a surface water connection between wetlands and the Yakima River, it is excluded from the shoreline jurisdiction. Information regarding irrigation canals, and additional water body exclusions, is provided in the *Ecosystem Profile* section under the heading *Wetlands*.

Functional Assessment

The analysis of ecological processes and functions provides the context for management of the City's shoreline. The analysis follows Ecology's *Shoreline Master Program Guidelines* (WAC 173-26) and evaluates the functions of the City shoreline at a reach scale. Conceptually, ecosystem functions are those aspects of the ecosystem that are beneficial either biologically, economically, or aesthetically. Ecosystem processes are comprised of physical

and biological (habitat) interactions. These processes are interrelated, with each process interacting with the others. Ecosystem functions are dependent on a range of ecosystem processes, which are influenced or determined by the regime of ecosystem stressors acting on the system. Effectively managing ecosystem stressors is necessary to maintain ecosystem processes that allow nature to sustain a suite of beneficial functions.

Ecosystem processes, defined as "…the suite of naturally occurring physical and geological processes of erosion, transport, and deposition; and specific chemical processes that shape landforms within a specific shoreline ecosystem and determine both the types of habitat and the associated ecological functions" (WAC 173-26-020-12), are dependent on natural and anthropogenic controlling factors or ecosystem stressors. In a properly functioning ecosystem, the controlling factors occur within the naturally occurring range under which the ecosystem evolved, and the ecosystem in turn provides the suite of naturally occurring associated functions. Ecological processes considered in this assessment include, for example:

- Flow and movement of water
- Erosion, and sediment transport and deposition
- Vegetation development and succession
- Energy and nutrient cycling

Those processes and the associated functions can be influenced or impaired by stressors including the following:

- Ground clearing or excavation
- Shoreline filling
- Channel or bank alteration (e.g., armoring)
- Impervious surfaces
- In-water and over-water structures
- Point source pollution
- Non-point source pollution
- Riparian vegetation removal
- Invasive species
- Freshwater sources, withdrawals, and flow controls

Ecological functions of the City's shoreline are summarized in Table 2. The ecological functions of the City's shorelines are organized based upon the functions of those systems described in Ecology's *Comprehensive Process to Prepare or Amend Shoreline Master Programs* (WAC 173-26-201) for rivers, streams, and associated wetlands.

City of West Richland SMP Inventory

Figure 1
Proposed Shoreline Jurisdiction

City Limits

Proposed Shoreline Jurisdiction

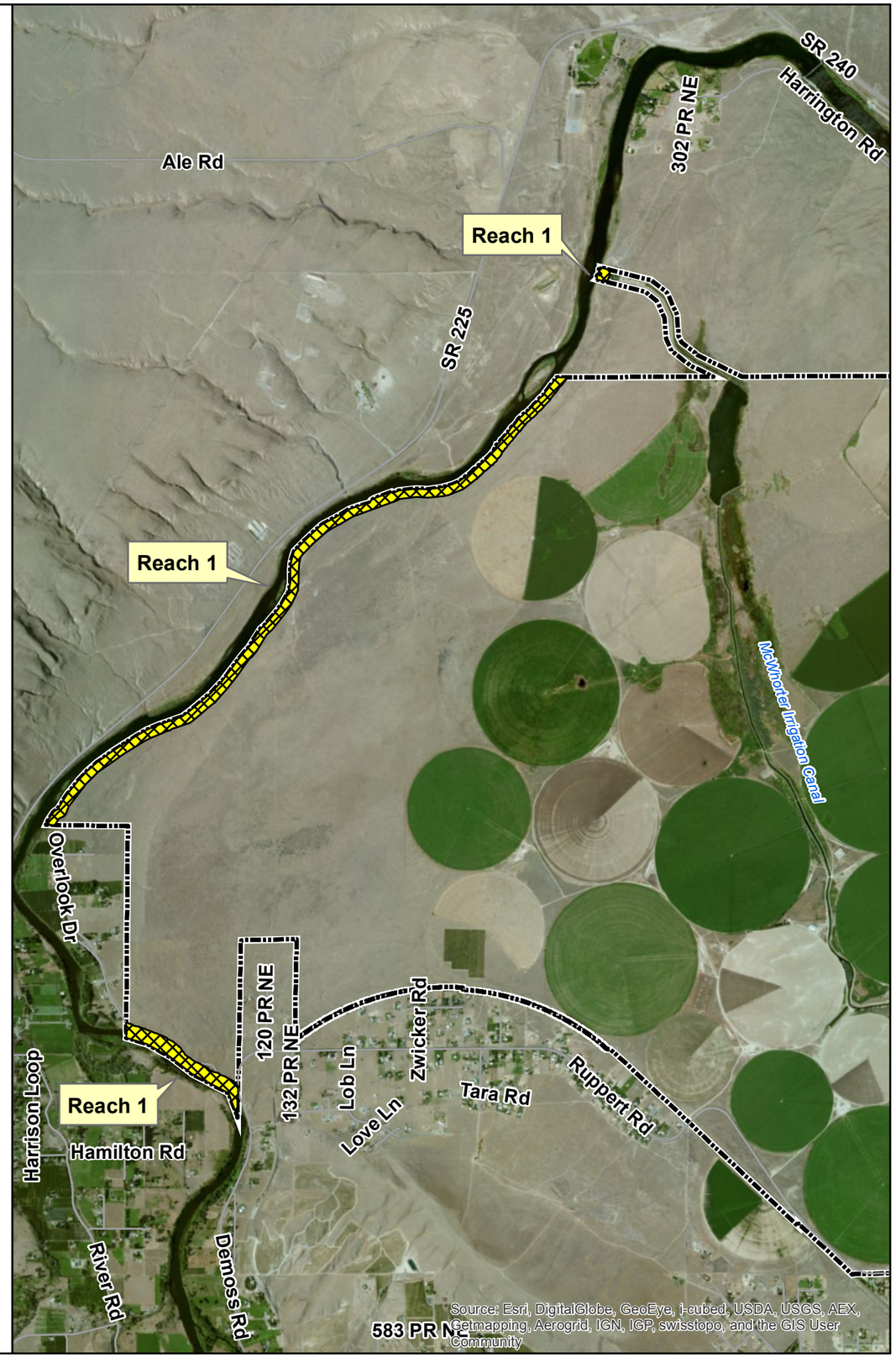
N

0 2,000 4,000

Feet

Map Date: July 2013

Shoreline jurisdiction boundaries depicted on this map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm/verify information shown on this map.



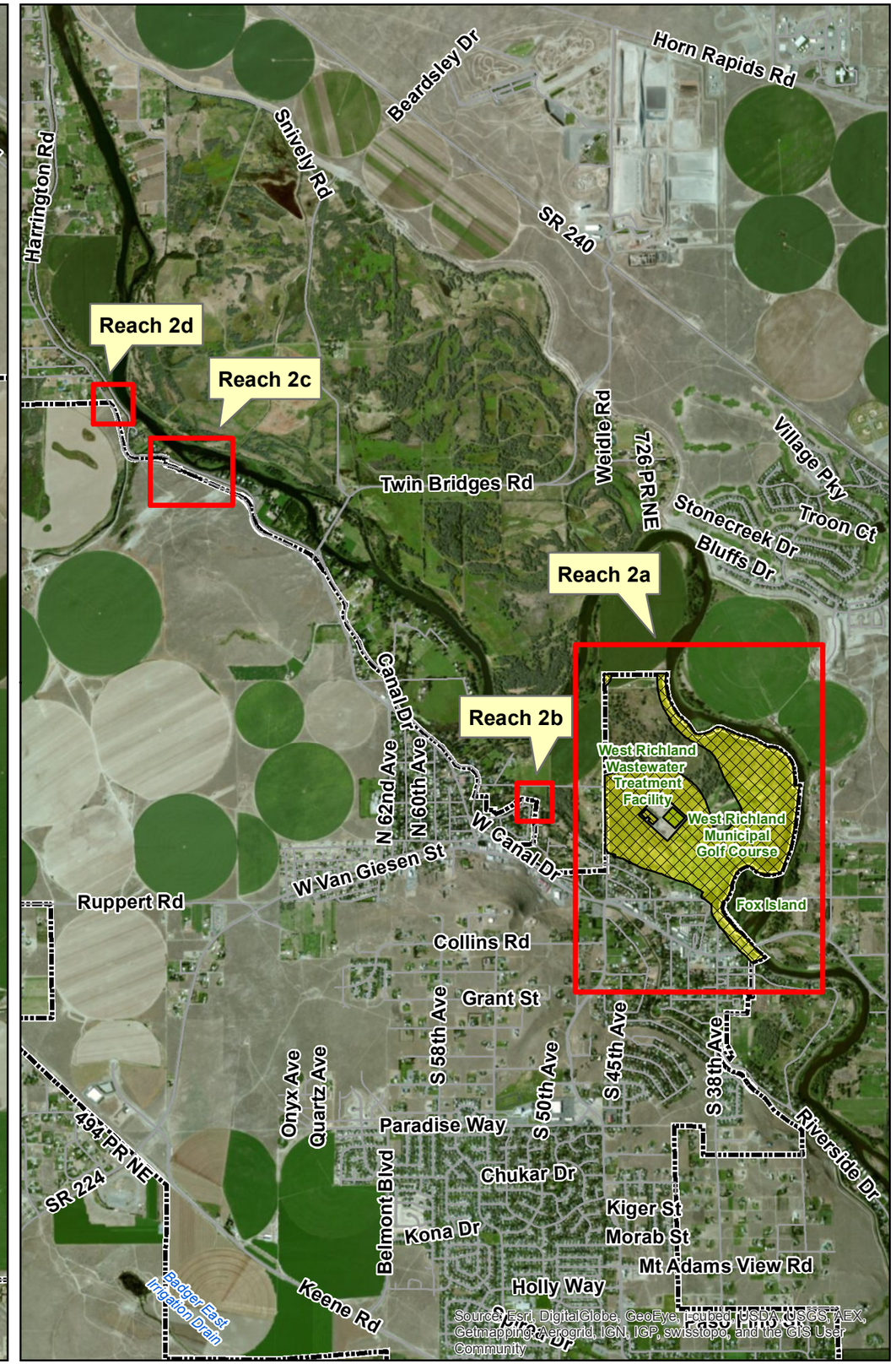


Table 2. Summary of Shoreline Functions for Rivers, Streams, and Wetlands.			
Hydrologic Functions	**Shoreline Vegetation Functions**	**Hyporheic Functions**	**Habitat Functions**
• Transport of water and sediment across the natural range of flow variability • Attenuating flow energy • Developing pools, riffles, gravel bars, nutrient flux, recruitment and transport of large woody debris and other organic material	• Maintaining temperature • Removing excessive nutrients and toxic compounds • Sediment removal and stabilization • Attenuation of high stream flow energy • Provision of recruitable woody debris and other organic material	• Removing excessive nutrients and toxic compounds • Water storage • Support of vegetation • Sediment storage • Maintenance of base flows	• Physical space and conditions to support water-dependent species and life history stages; reproduction; resting, hiding and migration; and food production and delivery

As part of this inventory and characterization, shoreline functions are assessed based on the processes and functions present in the study area. The available information gathered for the study area was used to determine the relative performance of each reach, and its potential to provide shoreline functions.

Functions in each reach were evaluated to determine if they are present, altered, or impaired. Functions of reaches in the study area were rated based on the criteria in Table 3. Table 3 is generally consistent with the functional assessment criteria for the Yakima River proposed by Benton County. The functional assessment criteria establish a framework for identifying potential areas for development, restoration or protection. In general, the higher the score for functions the more likely the site is suitable for protection, while areas with low function scores in combination with few alterations are suitable for restoration. Development is typically most suitable for areas with many alterations and low function scores.

Table 3. Reach-scale Functional Assessment Criteria.				
	Function	**High**	**Moderate**	**Low**
Hydrologic	Transport of water and sediment	No armoring or dams present in the reach Creek mouths with natural deltas are present	Steep slopes present, but not developed, or are well vegetated Limited armoring	Steep slopes present with development
	Attenuation of flow energy	Majority of the reach is not armored or protected by levees Large wetlands or backwaters present Floodway is >50% of area Wide floodplain Channel and flow configuration is complex	Majority of the reach is not armored or protected by levees Few wetlands or backwaters present Floodway is 20-50% of area	Significant armoring or levees present Few wetlands or backwaters present Floodway is <20% of area Channel and flow configuration is simple
	Developing pools, riffles, gravel bars, nutrient flux, recruitment and transport of large woody debris and other organic material	High level of features are present OR Channel and flow configuration is complex, and not impaired by bank armoring	Low to moderate level of features are present OR Channel and flow configuration is moderately complex or simple, but not impaired by bank armoring	Low level of features are present OR Channel and flow configuration is simple primarily because of bank armoring or other development
Vegetation	Maintaining Temperature	Dense vegetation provides >25% cover	25-75% moderate or sparse vegetation cover	<25% vegetation cover
	Removing excessive nutrients and toxic compounds	303(d) Category 1, no problems	303(d) Category 4 - Impaired, does not require total maximum daily load (TMDL) OR 303d Category 2, waters of concern OR Suspected sources of water quality concern	303(d) Category 5 - Impaired, requires TMDL
	Sediment removal and stabilization	A broad band of dense vegetation separates uplands from shoreline Trees and shrubs stabilize banks	A narrow band of dense vegetation or a broad band of sparse vegetation separates uplands from shoreline OR Portion of the shoreline is armored	No vegetation or a narrow band of sparse vegetation separates uplands form shoreline OR A majority of the reach is armored

Table 3 (continued). Reach-scale Functional Assessment Criteria.				
	Function	**High**	**Moderate**	**Low**
Vegetation (cont'd)	Attenuation of high stream flow energy	Majority of the reach is not armored or protected by levees Large wetlands or backwaters present Floodway is >50% of area	Majority of the reach is not armored or protected by levees Few wetlands or backwaters present Floodway is 20-50% of area	Significant armoring or levees present Few wetlands or backwaters present Floodway is <20% of area OR Low energy wetland environment with limited connectivity to streams
	Provision of recruitable woody debris and other organic material	Dense vegetation provides >25% cover	25-75% moderate or sparse vegetation cover	<25% vegetation cover
Hyporheic	Water storage, sediment storage, maintaining base flows, and removing excessive nutrients and toxic compound	Wetlands are present and not separated from river by armoring or levees	Few wetlands are present or are separated by levees	Wetlands are absent or largely separated by levees
	Support of vegetation	Large wetlands are present OR Alluvial soils comprise >75% of the reach	Shoreline supports moderate scrub or forest vegetation Alluvial soils comprise 10-75% of the reach	Shoreline supports little to no scrub or forest vegetation Alluvial soils comprise >10% of the reach
Habitat	Physical space and conditions to support water-dependent species and life history stages; reproduction; resting, hiding and migration; and food production and delivery	High wetland presence Broad band of moderate to dense riparian vegetation OR Narrow band of dense vegetation High channel sinuosity or bed and bank complexity Priority habitat features >50% of area and corridors between habitats are free from roads and other development	Moderate wetland presence Narrow band of dense vegetation or broad band of sparse vegetation Moderate to high channel sinuosity or bed and bank complexity Priority species or habitat features are present but corridors between habitats may be degraded	Few or no wetlands present Dense riparian vegetation is absent Low channel sinuosity or bed and bank complexity Priority habitat features are present but corridors between habitats are absent or degraded

ECOSYSTEM PROFILE

Regional Overview

West Richland is located in Major Land Resource Area 7, the Columbia Basin (USDA 2006). Elevations in the Columbia Basin range from 300 to 2,000 feet above mean sea level. The Columbia basin landscape consists of broad gently sloping plains interspersed with east-west trending ridges. The plains were formed by Miocene flood basalts that were later covered by sediments laid down by temporary lakes during outburst floods from glacial lakes Missoula and Columbia. The ridges are formed by folds and thrust faults in the underlying basalts that result from rotational compression of the northwest corner of the North American plate.

The Columbia Basin climate is warm and dry, with annual average precipitation between 6 and 10 inches, two-thirds of which occurs as winter rain and snow. Native vegetation in the Columbia Basin consists of shrub-grass associations, which cover about 40 percent of the basin, and are used for cattle grazing. Another 40 percent of the basin is used for irrigated crops. Urban and natural areas account for the remaining 20 percent of the land area (USDA 2006).

Despite being located in the rain shadow of the Cascade Mountains, the Columbia Basin is well supplied with surface water from the Columbia, Snake, and Yakima rivers. Surface water supplies are dominated by snowmelt, and in the case of the Yakima River, are affected by storage and diversion for irrigation. Natural stream flow in the Yakima River is driven by the climate of the eastern slope of the Cascade Mountains, where annual precipitation ranges from 12 to 87 inches, much of it falling as snow in winter. Between its headwaters and the study area, the Yakima River passes through a series of water-supply reservoirs and alluvial valleys in which water is diverted for irrigation use. Natural stream-flow is therefore seldom observed, except when peak rain-on-snow events exceed the storage capacity of the reservoirs.

Key Physical Controls

Climate and Climate Change

The study area is located in the warmest and driest part of the Columbia Plateau. Temperature, cloud cover, and precipitation vary throughout the year; warm, clear, and dry summers alternate with relatively cool, cloudy, and wet winters. The average annual temperature is 50 degrees Fahrenheit (°F) with a strong seasonal gradient between winter and summer; In January temperatures on average vary between 26 and 41°F, while at the peak of summer in July temperatures on average vary between 60 and 90°F. The average number of cloudy days varies from 24 days in January to 4 days in July. Average annual precipitation is 7.1 inches, most of which is delivered in winter by low-intensity Pacific frontal storms as mixed rain and snow. Average monthly precipitation varies from 1.1 inches

in December to 0.2 inches in July. Average annual snowfall is 8 inches, delivered between November and March; average monthly snowfall is 3 inches in January, 0 inches from April to October.

Shorelines in the City are affected by the larger scale regional climate that controls streamflow in the Yakima River basin, as well as by local climate. At the headwaters of the Yakima River, the cooling of moist air from the Pacific Ocean causes high precipitation along the Cascade crest, while warming and drying of descending air masses east of the crest result in a strong rain shadow. Three quarters of annual precipitation falls between October through March, much of it as snowfall along the crest. Snowpack builds from October through April. Dry season is from late spring through summer, with less than 5 percent of precipitation occurring in July and August. High elevation snowpack remains until June or later, causing runoff to persist well into summer. Estimates of the unregulated hydrograph in the lower basin show annual peaks in April through June, with annual lows in September or October (Ring and Watson 1999). Climate change is expected to cause continued decline in snowpack, and earlier snowmelt. The Washington Cascade Mountains, from which the Yakima River drains, are likely to lose about 20 percent of their April 1 snowpack with 1.8°F of climate warming (Vano et al. 2010).

University of Washington Climate Impacts Group (ICG) models of expected snow pack loss due to climate change show that snow water equivalent, which is the amount of water contained in snowpack if it were instantaneously melted, will decline in the Yakima River watershed from a historical peak of 7 inches to 5 inches by 2020, 4 inches by 2040, and 2 inches by 2080 (Hamlet et al. 2010). Other research has shown that snowpack water storage has already declined over the 20th century, and climate change will cause more precipitation to fall as rain rather than snow in the future. This change is expected to increase winter flows and reduce summer flows in rivers and creeks (Adams et al. 2010).

Topography

West Richland is located at the southeast corner of the Yakima fold belt, an alternating series of broad valleys separated by large east-west trending anticlinal ridges, at a point where the fold belt intersects the relatively flat terrain of the Columbia Basin. The City itself lies at an elevation of 413 feet in a valley between two of these anticlinal ridges. To the south and west of the City lies a series of peaks: Badger Mountain, Candy Mountain, and Red Mountain. These peaks delineate a structural ridge that extends to the northwest on the other side of the Yakima River as Rattlesnake Mountain. To the east of town, the ridge structure is more subtly expressed as a lower and more widely spaced series of hills from Flat Top Hill at the south end to the Horn at the north. The Yakima River enters the valley through the gap between Red Mountain and Rattlesnake Mountain, flows northwest across the valley along the flank of Rattlesnake Mountain to the Horn, where it turns sharply to the southeast and flows in an alluvial valley along the eastern side of the lower ridge.

The City abuts the Yakima River in two distinct reaches, the characteristics of which are strongly influenced by their topographic position. Along the northwest municipal boundary, the river flows in a narrow depression against the southeast flank of Rattlesnake Mountain. After leaving the City, the river continues northeast towards the Horn. On the east side, the

river comes back in contact with the municipal boundary along a meander bend in the alluvial valley that lies to the north and east of the City. The consequences for shoreline processes are discussed in *Physical and Biological Characterization of Reaches*.

Geology

Yakima River basin geology is characterized by two main regions: a Cascade Mountains province in the northwestern Yakima basin with a varied suite of older rocks; and the Columbia Plateau province, where a thick sequence of basaltic lava flows and overlying sediments cover the older rocks (Ring and Watson 1999). The City lies in the Columbia Plateau province, so underlying rocks consists of Miocene basalt and unconsolidated Quaternary sediments. Most of the City is underlain by Quaternary sand and silt deposits from Lake Missoula outburst floods. Hilltops and ridges expose Miocene basalt flows, which also underlie the Quaternary alluvium that forms the Yakima River floodplains.

As the Yakima River approaches and flows past the City, it progresses from a basaltic constriction, across a basin where it comes in contact with both basaltic and sedimentary rocks, through another basaltic constriction, and into an alluvial valley. Where the Yakima River crosses Quaternary sediments and alluvial valleys, it has historically tended to lose flow, and where it crosses basaltic constrictions, it has tended to gain flow (Jones et al. 2006). In the study area, the Yakima River is a losing reach (Vaccarro 2011), meaning that there is a net decline in stream-flow and recharge of shallow groundwater as the river loops around the City.

Soils

Dominant soil orders in the study area are Aridisols and Entisols. They are of mixed mineralogy, generally loamy, moderately to very deep, and well drained to excessively drained. Soils along the City's shorelines include sands, loamy sands, sandy loams, and silt loams of the Burbank, Hezel, Pasco, Scooteney, Starbuck, Quincy, and Warden series (NRCS 2012). The Burbank series consists of very deep excessively drained soils formed in basaltic glacial outwash or alluvium. The Hezel series consists of very deep, somewhat excessively drained soils formed in glaciofluvial sediments with a mantle of eolian sand. Pasco series soils formed in recent alluvium accumulating under ponded drainage conditions. The Scooteney series consists of very deep well-drained soils formed in alluvium on alluvial fans and terraces. The Starbuck series consists of shallow, well drained soils formed in loess, colluvium, residuum and alluvium over basalt on benches, hillsides, and ridge-tops. The Quincy series consists of deep, excessively drained soils formed in sands on dunes and terraces. The Warden series consists of very deep and deep, well drained soils formed in a thin mantle of loess over lacustrine sediments.

Key Ecosystem Processes

Along an altitudinal gradient from the source (high gradient largely constrained headwaters) to its mouth (a deltaic floodplain at the confluence with the Columbia River), the Yakima River basin exhibits distinct hydrological and geomorphic processes. The study area is within an area of the Yakima River that is meandering with expansive floodplains that contain

oxbows and other lower valley features. In gravel bed rivers, reaches with alluvial floodplains have been shown to be centers of biological productivity and ecological diversity (Haring 2001).

Historically, vast alluvial floodplains were connected to complex webs of braids and distributary channels. The large hydrological buffers functioned to spread and diminish peak flows, promoting infiltration of cold water into the underlying gravels. In general, the lower Yakima River valley contained side channels and sloughs, providing a large area of edge habitat and a variety of thermal and velocity regimes. Key processes in the Yakima River basin have been highly altered by development of dams for hydroelectricity and the storage and delivery of water for irrigation. Several low-head diversion dams are located on the main stem of the Yakima River including Easton, Town Ditch, Roza, Wapato, Sunnyside, Prosser, and Horn Rapids. Key ecosystem processes such as flow and movement of water, erosion and sediment transport, and nutrient cycling, are described in more detail in the *Reach Analysis* section.

Land Use and Land Cover

This section reviews current and planned land use in the shoreline jurisdiction. The intent is to provide a basis to establish a compatible use pattern over the 20-year planning period of the SMP. It is also intended to identify current or planned preferred uses in the shoreline jurisdiction that should be protected or promoted to meet SMA goals for water-oriented uses, shoreline access, and ecological protection. The SMA promotes the following use preferences (RCW 90.58.020) for shorelines of statewide significance in the stated order, which in the City includes the Yakima River pursuant to the definition of shorelines of the state in RCW 90.58.030, described previously:

1. Recognize and protect the statewide interest over local interest
2. Preserve the natural character of the shoreline
3. Provide for long term benefits over short term benefits
4. Protect the resources and ecology of the shoreline
5. Increase public access to publicly owned areas of the shorelines
6. Increase recreational opportunities for the public in the shoreline
7. Provide for any other element as defined in RCW 90.58.100 deemed appropriate or necessary

Existing land cover, zoning designations, and aerial imagery provide a baseline for the types of land use found within the shoreline jurisdiction. Future land use and current zoning data for the area covered by the City's shoreline jurisdiction were obtained from the City, and existing land cover data were derived from the National Land Cover Database. These data sets are overlaid on the inventory maps in Appendix A.

Shoreline land uses within the shoreline jurisdiction are comprised of undeveloped low density residential zones, developed and undeveloped medium density residential zones,

medium density commercial areas, and public parks and recreation (open space and West Richland Golf Course). The commercial area adjacent to the Van Giesen (SR 224) Bridge, and the golf course and water treatment facility north of the bridge, may be areas of most intensive use in the shoreline jurisdiction. Much of the remaining shoreline jurisdiction is currently undeveloped. The shoreline jurisdiction is dominated by upland shrub/scrub, developed open space, and cultivated crops land cover classifications (Figures 5.1 and 5.2 in Appendix A).

According to Ecology's SMP Guidelines (WAC 173-26-020), "water-oriented use" means a use that is water-dependent, water-related, or water-enjoyment, or a combination of such uses. The SMA promotes uses that are "unique to or dependent upon use of the state's shoreline" as well as:

> "ports, shoreline recreational uses including but not limited to parks, marinas, piers, and other improvements facilitating public access to shorelines of the state, industrial and commercial developments which are particularly dependent on their location on or use of the shorelines of the state and other development that will provide an opportunity for substantial numbers of the people to enjoy the shorelines of the state." (RCW 90.58.020)

Definitions and examples of water-oriented uses are included in Table 4 below.

Based on a review of land cover and zoning maps, the current use categories that were considered most likely to meet the definition of water-oriented uses were selected as follows:

- Agriculture
- Public Parks and Recreation (West Richland Golf Course)

Although not always considered a water-oriented use, agriculture is a water-oriented use to the extent that it is dependent on close proximity to a shoreline for access to water or relies on water from irrigation infrastructure for economic viability. While residential and commercial development is not currently prevalent within the shoreline jurisdiction, low density residential zoning is in place in most of Reach 1, which would allow residential and commercial development to occur in this area in the future.

Historical and Cultural Resources

The City is in a region that was originally inhabited by the Chemnapum Indians (closely related to the Wanapum tribe). The City was incorporated in 1955 and combined the towns of Heminger and Enterprise, which had established across the Yakima River from Richland in the 1940s. Washington State Department of Archeology and Historic Preservation (DAHP) records did not indicate the presence of any Historic Register properties in the study area (DAHP 2012). Although there are no properties currently listed on the National Historic Register there are numerous historic structures that may be eligible for listing. These are concentrated in the vicinity of Reach 2. DAHP also maintains a statewide archaeological predictive model. This model may be referenced during individual project permitting reviews to identify areas that do not have currently known archaeological sites, but that have high potential to contain archaeological sites.

Table 4. Water-Oriented Uses Definitions and Examples.	
Water-Oriented Use Definitions	**Water-Oriented Use Examples**
"Water-dependent use" means a use or portion of a use which cannot exist in a location that is not adjacent to the water and which is dependent on the water by reason of the intrinsic nature of its operations. (WAC 173-26-020(36))	Examples of water-dependent uses may include ship cargo terminal loading areas, ferry and passenger terminals, barge loading facilities, shipbuilding and dry-docking, marinas, aquaculture, float plane facilities and sewer outfalls.
"Water-related use" means a use or portion of a use which is not intrinsically dependent on a waterfront location but whose economic viability is dependent upon a waterfront location because: (a) The use has a functional requirement for a waterfront location such as the arrival or shipment of materials by water or the need for large quantities of water; or (b) The use provides a necessary service supportive of the water-dependent uses and the proximity of the use to its customers makes its services less expensive and/or more convenient. (WAC 173-26-020 (40))	Examples of water-related uses may include warehousing of goods transported by water, seafood processing plants, hydroelectric generating plants, gravel storage when transported by barge, oil refineries where transport is by tanker, log storage, and potentially agriculture.
"Water-enjoyment use" means a recreational use or other use that facilitates public access to the shoreline as a primary characteristic of the use; or a use that provides for recreational use or aesthetic enjoyment of the shoreline for a substantial number of people as a general characteristic of the use and which through location, design, and operation ensures the public's ability to enjoy the physical and aesthetic qualities of the shoreline. In order to qualify as a water-enjoyment use, the use must be open to the general public and the shoreline-oriented space within the project must be devoted to the specific aspects of the use that fosters shoreline enjoyment. (WAC 173-26-020 (37))	Primary water-enjoyment uses may include, but are not limited to, parks, piers and other improvements facilitating public access to the shorelines of the state; and general water-enjoyment uses may include, but are not limited to restaurants, museums, aquariums, scientific/ecological reserves, and resorts/hotels.

Public Access

Public water access and park facilities were not identified within the SMP jurisdiction boundary (WSRCO 2012, WDFW 2012a). One water access structure (i.e., boat launch) is located at Horn Rapids County Park on the Yakima River between reaches of the study area, but this is outside the City.

Shoreline Alterations

Shoreline modifications in the study area have not been mapped and there is no comprehensive statewide or local jurisdiction map for shoreline modifications and stream alterations. The limited availability of information on shoreline alterations is a potential data gap which, in turn, limits the functional assessment of the study area. However, shoreline alterations have not been considered a primary or priority limiting factor for salmon in the

watershed (Haring 2001). Therefore, an assessment using aerial imagery is considered sufficient for this shoreline functional assessment.

Key Habitat and Species

This section describes priority habitats and species of state and local concern including streams, wetlands, riparian vegetation, fish, and other wildlife dependent on water and shoreline environments in the study area. Priority habitats and species are shown on Figures 8.1 and 8.2 in Appendix A.

Streams

The Yakima River and Naches River serve as irrigation supply water for approximately 339,200 acres of cropland in the lower Yakima Valley. The irrigation season commences in mid- to late-March and ends in mid-October (Joy and Patterson 1997). Between 50 percent and 100 percent of the water delivered to the lower basin from the Naches River and upper Yakima River is diverted for irrigation and hydropower generation during the irrigation season (Molenaar 1985). Past concerns over insufficient flows resulted in restrictions that require minimum flows to pass over dams into the lower river basin. The lower basin also slowly recovers some of the water diverted for irrigation through surface and subsurface returns (Joy and Patterson 1997).

Hydrology

Historically, the exchange between surface, hyporheic, and groundwater zones was common in the vast alluvial valleys and floodplains. In an unregulated condition, the valleys and floodplains acted as buffers to runoff by distributing peak flows, and moving cool melt water across the floodplain (Haring 2001; Snyder and Stanford 2001). However, the channel has downcut over time, thus becoming isolated from the adjacent floodplain. In addition, flow in the Yakima Basin is highly altered through regulation, primarily by the storage and delivery of water for irrigation. Several low-head diversion dams are located on the main stem of the Yakima River including Easton, Town Ditch, Roza, Wapato, Sunnyside, Prosser, and Horn Rapids.

The spring inundation historically recharged the shallow aquifers, which provided areas of cold thermal refugia to aquatic species throughout the summer. The spring inundation also maintained connectivity of flow to backwaters and spring brook habitats (Snyder and Stanford 2001). Historically, low flows occurred September through October. Peak runoff in the Yakima Basin occurred April through June, and was driven primarily by snowmelt from the Cascade Mountains (Ring and Watson 1999). Major flooding, both historically and presently, usually occurs from rain-on-snow events coupled with rapid thaw in the wintertime, mid-November through February.

Presently, higher flows are maintained with reservoir releases during the summer and early fall for irrigation purposes. Flow pulses in this river section are dampened or absent in the spring of most years due to reservoir refill operations, affecting outmigration for all salmonid smolts produced upstream in the basin; and summer flows are low, negatively

affecting salmonid rearing and migration conditions (USDI 2012). Capturing spring freshets has reduced the frequency and intensity of significant channel forming flood events. However, not all flooding is controlled by storage and high discharge events still occur occasionally, providing enough energy to reshape portions of the river and adjacent vegetation (USDI 2002). Nonetheless, the 47-mile long segment of river from the Prosser Dam to the mouth, including the study area, is a single meandering channel with few braids or mid-channel islands.

Water Quality

Ecology conducts water quality monitoring at a station upstream of the study reach, at river mile (RM) 19.8 near Kiona. Overall water quality at this station is of moderate concern (Ecology 2012a). There are several ongoing plans to control pollutants and improve water quality in the Yakima River, including a total maximum daily load (TMDL) for suspended sediment (Ecology 1998), and the organochlorine compound dichlorodiphenyltrichloroethane (DDT) (Johnson et al. 2010). Ecology is developing a new water quality improvement plan that includes a new evaluation of current levels of DDT in the lower Yakima River valley, sets human health clean-up targets for DDT, and lays a path to achieve these targets (Ecology 2012b). Ecology's Environmental Assessment Program has completed two studies that evaluate pollutant levels for the current water quality improvement project (Johnson et al. 2007, 2010).

Suspended sediment and persistent pesticide loads from irrigated agricultural areas of the lower Yakima River basin have long been recognized as impairments to water quality. Nonionic (i.e., not dependent on a surface-active anion for effect) pesticides have been used extensively on the agricultural crops of the Yakima Valley since at least the 1950s. In general, the organochlorine compounds, such as DDT, dieldrin, and endosulfan, have been the most frequently detected pesticides in basin waters, sediments, and biota due to their persistence in the environment, and heavy use in the past. Throughout the watershed, most of the water from irrigation return drains and tributaries contains elevated levels of suspended sediments, pesticides, nutrients, bacteria, and oxygen demanding substances. Therefore, the impacts of soil erosion, sediment, and DDT on aquatic resources have been the focus of numerous activities by several agencies.

Wetlands

Although extensive wetlands are not mapped along the Yakima River in the study area, there are riverine fringe wetlands associated with the stream at various locations along the study area reaches. There is also a large wetland complex associated with the irrigation canal that connects, via the McWhorter irrigation canal, to the Yakima River. The wetland complex is hydrologically connected with the Yakima River but is excluded from the SMA jurisdiction due to its association with the McWhorter irrigation canal. The irrigation canal is unregulated by the SMP, consistent with provisions of the SMA that include exemptions for agricultural and irrigation activities in RCW 90.58.030(3)(e). Specific exemptions in the Code include the following:

- Construction and practices normal or necessary for farming, irrigation, and ranching activities, including agricultural service roads and utilities on shorelands, and the

construction and maintenance of irrigation structures including but not limited to head gates, pumping facilities, and irrigation channels

- Operation, maintenance, or construction of canals, waterways, drains, reservoirs, or other facilities that now exist or are hereafter created or developed as a part of an irrigation system for the primary purpose of making use of system waters, including return flow and artificially stored ground water for the irrigation of lands
- Operation and maintenance of any system of dikes, ditches, drains, or other facilities existing on September 8, 1975, which were created, developed, or utilized primarily as a part of an agricultural drainage or diking system

The McWhorter irrigation canal and associated wetland are appropriately excluded from the shorelines of the state and City's SMA jurisdiction for the following reasons:

- The wetland is part of an artificially created agriculture channel (the McWhorter Canal) that extends to the north and the south that is used by the McWhorter Ranch for irrigation. The irrigation canal is explicitly excluded from the definition of a stream under WAC 173-22-030(8)(b).
- The wetland did not exist until the irrigation canal and supporting pumps that maintain its flow were built.
- The irrigation canal and associated wetland were constructed, and are operated and maintained to meet a specific commercial need as part of a managed agricultural irrigation system.
- The wetland would not continue to exist unless the McWhorter Ranch properly maintained the larger constructed irrigation system.
- Access to the wetland is restricted to people operating the larger irrigation facility. No recreation or other activities are allowed.
- One agricultural landowner, the McWhorter Ranch, surrounds the wetland.
- The canal and associated wetland were not intentionally built to support fish or wildlife habitat.
- Ingress and egress to and from the Yakima River is controlled and mechanized. A piped irrigation pump system starting at the Yakima River brings the water uphill to a constructed irrigation canal that then travels more than a mile to the wetland, and discharges at the southern end of the wetland.
- Surface continuity with the Yakima River is discontinuous as artificial pipes, pumps, and dikes interrupt it.
- The wetland does not fall within the shoreline jurisdiction of the Yakima River.

Other waters in the study area are also excluded from the SMP based on similar conditions and the same rational from RCW 90.58.030(3)(e) listed above. For example, the Badger East

irrigation drain operated by the Kennewick Irrigation District crosses the southwest corner of the City. The irrigation drain is an artificial channel that spills excess operational return flows from the Irrigation District's Badger East Lateral Canal.

Riparian Vegetation

Significant overhanging vegetation is naturally limited along reaches in the study area, which are dominated by cool semi-desert scrub and grassland vegetation. The study area is characterized primarily by a combination of Inter-mountain basins big sagebrush scrubland, and big sagebrush steppe ecological systems (USGS 2011). Terrestrial habitat was described as sage brush and bitterbrush dominated shrub steppe, bunchgrass understory with forbs, and cryptogram crust (YSFWPB 2004). This is likely consistent with geologically recent (few hundred years) historical conditions. The dominant vegetation in areas that are unaltered by agriculture or development, including much of the study area, likely resemble historical conditions that existed prior to settlement in the semi-arid lowland valleys and canyons of the Yakima River basin including the study area and surrounding region.

Priority Fish

Priority and sensitive fish species in the study area are summarized in Table 5. The following sections focus on native wild fish. However, spring releases of hatchery fall and spring Chinook and coho salmon also occur. Approximately 2 million fall Chinook, 800,000 spring Chinook, and 1 million coho salmon are released into the Yakima River annually (Fritts and Pearsons 2006).

Table 5. Sensitive Fish Presence and Use in West Richland Study Area.

Species / Run	Endangered Species Act Unit [a]	Presence / Stream Use Type [a]	Federal Listing Status [b]	State Listing Status [c]
Spring Chinook	Upper Columbia River Spring Run ESU [d]	Rearing	Endangered	Candidate
Fall Chinook	Upper Columbia River Summer/Fall Run ESU	Spawning, rearing	Not Warranted	Candidate
Coho	NA [e]	Presence Documented	NA	Not Listed
Summer Steelhead	Middle Columbia River DPS [f]	Presence Documented (potential rearing)	Threatened / designated critical habitat	Candidate
Bull Trout	Middle Columbia River Basin RU [g]	Presence presumed (potential rearing and migration)	Threatened / designated critical habitat	Candidate

[a] WDFW (2012b, 2012c)

[b] NMFS (2011), 64 FR 58909, 70 FR 52630, 75 FR 63898

[c] WDFW (2008)

[d] Evolutionarily Significant Unit

[e] Endemic coho were extirpated in the early 1980s; natural reproduction of hatchery-reared coho, out planted as smolts, is now occurring in both the Yakima and Naches Rivers (Haring 2001). The population is not a recognized ESU for the purposes of ESA (NMFS 2011).

[e] Recovery Unit

[f] Distinct Population Segment

Spring Chinook

The lower Yakima River including the study area provides rearing habitat for Spring Chinook stocks in the Middle and Upper Columbia River regions, including "depressed" stocks that spawn in the upper Yakima and Naches Rivers. Depressed stocks are those fish stocks whose production is below expected levels, based on available habitat and natural variations in survival rates, but above the level where permanent damage to the stock is likely. Of three stocks in the basin, the Upper Yakima Spring Chinook is the most abundant, and it was rated depressed in 2002. This stock enters the river from mid-April to early July, then spawns upstream of Roza Dam (RM 128) and the City of Ellensburg (RM 152.2) (Haring 2001; WDFW 2002). Timing for various life history stages is summarized in Table 6. This is a native stock with composite production, meaning there has been stock supplementation by releasing non-native hatchery fish (WDFW 2002). Hatchery-reared juveniles (primarily smolts) have been released into the Yakima Subbasin since at least 1959 and the degree of hybridization between indigenous Spring Chinook stocks and genetically foreign hatchery stocks is uncertain (Haring 2001).

Fall Chinook

The West Richland study area provides migration, rearing, or spawning habitat for a number of Yakima Basin salmon stocks including Marion Drain Fall Chinook and Yakima Bright Fall Chinook (WDFW 2002). The Fall Chinook populations have a stock status of "healthy."

Marion Drain Fall Chinook spawning generally begins on October 15 when irrigation pumps are turned off (allowing surplus water to flow back into the Yakima River via the Marion Drain), and peaks in early November. Yakima Bright Fall Chinook generally spawn in October in the lower 32 miles of the Yakima River.

Fall Chinook in the study area express a wide range of genetic and demographic diversity, and variability in run timing and spawn timing. Perhaps most pertinent to the study area is the main stem stock of Fall Chinook, which spawns in the lower Yakima River primarily below Wapato Dam (RM 106.7), and most intensively between the Benton City Bridge (RM 29.8) and Horn Rapids Dam (RM 18). Fall Chinook are likely to use habitat in the study reach during a range of life history stages between September when they enter the system and July when the juveniles out-migrate; thus, they are likely present throughout most of the year but may be absent in August. There is an area of upwelling in the floodplain of the river between approximately RM 8 and RM 16, including all of the study area (Haring 2001).

The source for this upwelling is likely from the Columbia River hyporheic zone to the north. This habitat characteristic may increase the suitability for Fall Chinook spawning due to preferable conditions for redds and egg survival; and relative cool temperatures that support rearing. Consistent with this assertion, the reach from the mouth to Kiona (RM 29) was identified as the primary Fall Chinook spawning area in the river main stem (CBSP 1990). Other anadromous salmonids use this segment of the Yakima River in the study area only for overwintering and migration because of high summer water temperatures.

Coho

Coho in the Yakima River basin and study area are present as a result of re-introduction efforts following extirpation of the stock that occurred by 1984. Survival of the lower watershed coho spawning is thought to be minimal, due primarily to high water temperatures in the lower watershed, including the study area. Coho migration timing is similar to that of steelhead (Haring 2001), described below.

Steelhead

The study area provides migration and possibly rearing habitat for Yakima Summer Steelhead and the Yakima River in the study area is designated critical habitat for threatened Middle Columbia River steelhead (70 FR 52630). The Summer Steelhead stock is depressed (WDFW 2002).

Most Yakima River Basin steelhead are tributary spawners. They may be present in the system, migrating or overwintering, throughout the year (Haring 2001). Steelhead spawning generally occurs in the upper Yakima tributaries from early late-February through early June (WDFW 2002). Steelhead adults begin passing Prosser Dam in September, cease movement during the colder parts of December and January, and resume migration from February through June (Haring 2001). The run has two peaks; one in late October, and one in late February or early March.

Steelhead passage in tributaries requires substantial flows during October to early December for spawners and juveniles may seek downstream winter habitat between October and early December; smolts migrate typically between March and early May (Haring 2001). Juvenile outmigration through the lower Yakima River begins in November and peaks between mid-April and May (Conely et al. 2009). Steelhead smolts have been observed passing Prosser into the middle of July, but typically the lower Yakima River has warmed to lethal temperatures by that time.

Several factors related to historical agricultural practices and irrigation withdrawals are commonly recognized as limiting salmon and steelhead survival, production, and population success in the Yakima River:

- Structural simplification of most of the anastomosing reaches of the main stem
- The partial or total blockage of spawning tributaries by irrigation diversion dams
- Wholesale entrainment of smolts in tributary and main stem irrigation diversions
- Release of large volumes of water from storage reservoirs in the summer
- Splash dams and log drives
- Riparian grazing, mowing, and limited bank cover
- High water temperatures in the lower reaches of tributaries and lower main stem

Table 6. Mean Timing of Life Stages of Yakima Basin Spring Chinook.

Life Stage	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Spawning Run				X	X	X	X	X	X																											
Spawning							X	X	X																											
Incubation							X	X	X	X	X	X	X	X	X	X	X																			
Emergence														X	X	X	X	X																		
Fry Colonization															X	X	X	X																		
Subyearling Rearing																X	X	X	X	X	X	X	X	X												
Winter Migration																						X	X	X	X											
Overwintering																								X	X	X	X									
Smolt Outmigration																											X	X	X	X						

Source: Haring (2001)

Bull Trout

Bull trout exhibit both migrant and resident life history strategies. There are resident, fluvial, and adfluvial bull trout stocks in the various headwater tributaries of the Yakima River watershed. The study area, which is designated critical habitat for threatened Middle Columbia River bull trout, likely supports both fluvial and adfluvial life history types (75 FR 63898; USFWS 2009). After rearing in natal streams bull trout migrate to larger rivers or reservoirs. Adults return to the river's main stem early in summer, often holding near their natal tributaries for months before migrating upstream. Occurrence in the study area is likely limited to migration between overwintering habitats and spawning and rearing habitats. The timing and location of spawning is uncertain but likely occurs in September in upper portions of the watershed outside the study area (WDFW 2004). Migration behavior and timing is less certain for bull trout compared to salmon in the Yakima River, but they are assumed potentially present throughout the year.

In the final rule listing bull trout under the Endangered Species Act (63 FR 31647), USFWS considered agricultural practices and associated water withdrawal as a threat to each subpopulation in the Yakima basin. Additional threats facing bull trout subpopulations in the basin included forestry, grazing, roads, mining, harvest, non-native species, and residential development.

Birds and Mammals

Documented wetland areas contain emergent and scrub-shrub vegetation and may host concentrations of waterfowl and game birds. In addition there are shrub-steppe habitat areas that are designated priority habitat and may host priority or sensitive upland game birds, deer and elk, and small mammals. Although these are not considered water-dependent species (species highly associated with and reliant on aquatic environments), the presence of priority habitat in the shoreline jurisdiction is a management consideration in establishing future land use patterns, regulations, and planning.

Invasive and Nuisance Aquatic Vegetation

Water stargrass, also known as grassleaf mudplantain (*Heteranthera dubia*) is a native submersed aquatic plant distributed widely throughout North and Central America (USDA 2013). In Washington, it occurs mostly in the central and eastern part of the state (Ecology 2013a) including the lower Yakima River. Although a native species, water stargrass can grow in high densities and become a nuisance. Abundant, nuisance growth of water stargrass occurs between the river mouth and RM 47, including the study area, and has been implicated in reducing water quality and habitat suitability for salmon (BCD 2013; Wise et al. 2009). Water stargrass typically grows in shallow water up to 1 meter deep (Ecology 2013a), but can grow at depths of more than 4 meters (Wise et al. 2009). It can become very dense, particularly in low flow draught years, covering salmon spawning grounds with thick root mats and impeding flow which can aggravate flooding. Control of the species in the lower Yakima River basin is currently led by the Benton Conservation District (BCD), and they have observed a steady increase in growth of water stargrass over the last decade (BCD 2013). Dense growth observed in the lower Yakima River in 2004 and 2005 draught years (Wise et al. 2009) was later reduced by naturally occurring flood events and higher flows that cleared much of the vegetation

away, or altered conditions such as higher turbidity and water depth during the spring growth period that reduced productivity compared to those years. However, BCD has been working with WDFW and local volunteers to clear areas of intense growth to restore fall Chinook salmon habitat (BCD 2013). Because protection and restoration of priority habitat, such as fall Chinook spawning habitat, is an important consideration for shoreline management and protection, strategies to monitor and control nuisance growth of water stargrass are important to effective restoration planning.

Flowering rush (*Butomus umbellatus*) can be found in waters up to 3 meters depth in a variety of wetlands, particularly along the shoreline of lakes and slow moving rivers (WSDA 2008). The species was added to the Washington State Class A noxious weed list in 2009. At the time, Ecology believed there were only two populations in the state, one in Silver Lake, Whatcom County, and one along a small stretch of the Yakima River in Benton County (Ecology 2013b; WSDA 2008). In the summer of 2009, substantially more flowering rush was found along the lower Yakima River in the vicinity of the SMP study area from Benton City to the mouth. The plants occurred as scattered individuals and patches. In 2010, the plant was found in the Columbia River at the mouth of the Yakima River, as well as other locations in the state. Populations have continued to expand in 2011 and 2012. Control efforts have included spraying all of the patches on the Yakima River, and efforts to control the spread of this plant, which is likely present in the study area, are expected to continue (Ecology 2013b). Class A noxious weeds are non-native species with limited distribution in Washington State. Eradicating existing infestations and preventing new infestations are the highest priorities, and required by law (NWCB 2013).

REACH ANALYSIS

Approach to Reach-scale Analysis

As described previously, the study area was divided into two reaches based on physical and ecological characteristics, land use, and development patterns (Figure 1 and Appendix A). Reach 2 is further divided into Areas 2a through 2d for the purpose of showing the small isolated areas that are within the SMA jurisdiction. The inventory and characterization, including physical and ecological conditions, is summarized in Table 7 and described in the following sections.

- **Reach 1** - Yakima River, west side of City
- **Reach 2** - Yakima River, east side of City near West Richland Golf Course

Reach 1 traverses northeast between two northwest-southeast trending anticlinal ridges. It is located in a shallow and narrow transverse valley at the north end of the larger structural valley formed by the two ridges. To the northwest of the river, the ground rises as the flank of the larger of the two ridges, while to the southeast the land is relatively flat. The channel migration zone of Reach 1 is constrained by the narrow width of the transverse valley, making it essentially a straight channel with little chance of migration.

Reach 2 is located where the Yakima River follows the edge of its alluvial valley above a thrust fault, with sandy outburst flood deposits underlying the City to the west and Quaternary alluvial deposits underlying the shoreline itself and the valley to the east. Evidence of valley-wide channel migration can be seen in aerial photographs. Where it crosses the City, the river forms a right looping meander bend within floodplain alluvium. The shoreline of Reach 2 is within the historic CMZ of the Yakima River.

Physical and Biological Characterization

Physical and biological characteristics are described in this section. Both reaches are discussed under each of the headings.

Physical Processes

Shorelines within the City are shaped by physical processes that occur at multiple scales, from infiltration of precipitation at the scale of individual soil units to stream-flow variations that are determined by basin-wide processes. These processes can be differentiated into hydrologic-related, which affect the distribution and flow of water, and hydraulic-related, which affect channel morphology, flow characteristics, and the storage and transport of sediment and large woody debris (LWD). Table 8 below illustrates the different processes that occur in each of the reaches.

Table 7. Reach-scale Inventory and Characterization Summary.		
	Reach 1: Yakima River West	**Reach 2: Yakima River East**
Physical Processes	• Runoff • Stream-flow • Hyporheic flow • Groundwater discharge/recharge • Overbank flow • Bank storage • Channel morphology • Sediment transport/storage • Development, transport, and retention of woody debris and organic material	• Runoff • Stream-flow • Hyporheic flow • Groundwater discharge/recharge • Overbank flow • Bank storage • Channel morphology • Sediment transport/storage • Development, transport, and retention of woody debris and organic material
Land Use [a]	PP 32.81% (29.9 acres) RL-40 65.91% (60.0 acres) RM-10 1.28% (1.2 acres)	AG 49.11% (128.4 acres) C 0.57% (1.5 acres) MR-3 0.57% (1.5 acres) PC 1.72% (4.5 acres) PP 46.72% (122.1 acres) RL-22 0.85% (2.2 acres) RM-10 0.46% (1.2 acres)
Land Cover	Cultivated Crops: 0.73% Developed, Low Intensity: 2.63% Developed, Open Space: 5.90% Emergent Herbaceous Wetlands: 0.15% Open Water: 28.93% Shrub/Scrub: 60.97% Woody Wetlands: 0.70%	Cultivated Crops: 48.14% Developed, Low Intensity: 2.61% Developed, Medium Intensity: 1.01% Developed, Open Space: 35.85% Emergent Herbaceous Wetlands: 0.35% Open Water: 5.75% Scrub-Shrub: 5.27% Woody Wetlands: 1.01%
Shoreline Modifications	Length of shoreline is 3.91 miles	Length of shoreline is 2.00 miles Levee in portion of reach
Water Quality	4,4'-DDE	Dissolved Oxygen pH
Public Access	No formal public access	No formal public access Gravel road and informal access (cleared area) present

Table 7 (continued). Reach-scale Inventory and Characterization Summary.		
	Reach 1: Yakima River West	**Reach 2: Yakima River East**
Fish Use	Spring Chinook Fall Chinook Coho Summer Steelhead Bull Trout	Spring Chinook Fall Chinook Coho Summer Steelhead Bull Trout
Priority Species and Habitats (including riparian areas and wetlands)	Extensive shrub-steppe habitat, few wetlands likely associated with river channel hyporheic zones	Wetland patches including narrow strips along bank of Yakima River
Restoration Opportunities (opportunities for protecting intact processes/functions or restoring impaired processes functions)	Water quality is impaired. Reach is currently undeveloped and therefore provides habitat functions that can be protected.	Water quality is impaired. Downcutting and a levee have likely reduced off-channel habitat and refugia from historical levels.
Protection / Restoration / Development Areas	Limited functions present but reach is currently undeveloped, indicating restoration or potentially protection would be appropriate throughout the reach.	Future development may be focused in areas already impacted by development such as adjacent roads and infrastructure. Less disturbed areas without roads and structures provide opportunities for protection.
Potential Measures to Protect / Restore Functions [b]	Water quality may be improved through programmatic restoration actions. Limit and regulate development in the buffer to protect current functions.	Implement programmatic restoration actions to improve water quality. Re-zoning from agriculture to light residential land use may allow restoration and increase of native vegetation communities to occur in areas without structures. Protect buffer with "set-backs" or other regulatory measures.
Public Land Use and Access Opportunities	City Parks and Recreation Plan anticipates developing more public access opportunities, potentially including a portion of Reach 1.	Potential locations for park site include Fox Island, downstream of the Van Giesen Bridge, or upstream of the golf course.

[a] Land Use designations: Agriculture (AG), Public Parks and Recreation (PP), Low Density Residential (RL), Medium Density Residential (RM), Multifamily residential (MR), Public Capital Facilities (PC), and Commercial Use (C).

[b] Specific measures to protect or restore functions to be determined in Restoration Plan (Phase 4 of SMP update).

Table 8. West Richland Study Area Physical Processes.		
Hydrologic/Hydraulic Processes	**Reach 1: Yakima River West**	**Reach 2: Yakima River East**
Runoff [a]	Drainage area 5,657 sq. mi., mean annual precipitation 29.8 in.	Drainage area 6,047 sq. mi., mean annual precipitation 28.5 in.
Stream-flow	Mean annual flow 3,484 cfs Typical low flow in August 1,000 cfs, ramping up to 6,000 cfs in early June, with winter/spring snowmelt peaks above 15,000 cfs	Similar in pattern to Reach 1 but lower due to West Richland area groundwater recharge and irrigation canal withdrawals
Hyporheic flow	Losing flow into groundwater	Unknown, probably spatially and temporally variable
Groundwater discharge/recharge	Groundwater recharge	Groundwater recharge likely dominant
Overbank flow	Narrow band, minimal flow resistance	Wide floodplain, vegetated banks
Bank storage	Negligible	Floodplain storage
Channel morphology	Low sinuosity stable channel	Meandering pool-riffle channel, stable vegetated bars
Flow characteristics	Simple	Complex
Sediment transport/storage	Transport dominated	Potential bank erosion, bar mobility, seasonal local deposition dominate
Development, transport, and retention of woody debris and organic material	Negligible	Potential recruitment from vegetated banks

[a] The mean annual precipitation is the total precipitation volume that falls on a watershed in an average year divided by the area of the watershed.

Key Physical and Habitat Functions

The City's shorelines affect physical functions that are related to the physical processes described above. These functions depend on the characteristics of each reach. For river reaches such as those in the City's shoreline jurisdiction, the functions include the transport of water and sediment at a range of flows; the attenuation of flow energy; the development of fluvial landforms including cut banks, pools, riffles, and gravel bars; recruitment, transport, and storage of LWD; surface-groundwater interactions; and sediment input and deposition. To the extent wetlands are present in local areas within the reaches, additional functions may include the interception and storage of surface water and sediment; attenuation of wave energy; and the recruitment of additional organic matter. Table 9 below illustrates the overall functional role of each reach.

Table 9. West Richland Shoreline Functions.		
Function	**Reach 1: Yakima River West**	**Reach 2: Yakima River East**
Transport of water and sediment at a range of flows	Minimal flow resistance	Resistance to flow, bank and floodplain storage
Water storage potential	Low	Low
Attenuation of flow energy	Minimal attenuation	Attenuation due to stream/floodplain complexity and bank vegetation
Development of fluvial landforms	Minimal	Pool-riffle sequences, bars, potential undercut banks
LWD and organic matter recruitment/storage	Negligible	Possible
Maintaining temperature	Low potential	Low potential
Nutrient and toxin removal	Negligible	Low potential to negligible
Surface-groundwater interactions	Shallow aquifer recharge	Meander-bend exchanges, pool-riffle hyporheic exchanges, groundwater exchange with floodplain
Sediment inputs/deposition	Transport dominated; negligible local input or deposition	Possible input/deposition due to meander migration
Interception/storage of surface water/sediment	n/a	n/a
Physical habitat conditions	Low sinuosity stable channel, likely spawning areas	Meandering pool-riffle channel, likely spawning areas, stable vegetated bars support potential food production/interactions

Land Use and Land Cover

Most (66 percent) of Reach 1, Yakima River West, is zoned for Low Density Residential development, although it is currently undeveloped scrub-steppe terrain. A portion (33 percent) in the northern, downstream extent of the reach is zoned Public Recreational, and is also undeveloped open space. Reach 2, Yakima River East, differs in that it is characterized by the wide floodplain, and public space, primarily the golf course, is the dominant land use. Cultivated cropland (48 percent) and open space (36 percent), including the golf course, dominate land cover in this reach; however, there are small inclusions of wetlands and low and medium intensity development, both residential and commercial.

Critical and Priority Habitat and Species

The Yakima River in Reach 1 and Reach 2 is designated critical habitat for threatened Middle Columbia River steelhead and bull trout (70 FR 52630, 75 FR 63898). For bull trout, the Yakima River is considered essential for conservation of upper and middle portions of the recovery unit. It is the largest core area for bull trout in Washington, unique in location and

population genetics, and contains unique habitat types important to both fluvial and adfluvial life history types (USFWS 2009). The Yakima River in the study area is designated critical habitat due to key foraging, migration, and overwintering habitat that maintains connectivity between populations and provides for the expression of historic migratory life history forms (USFWS 2009). Specific features that contribute to designated critical habitat for steelhead and bull trout have not been mapped in the study area but would generally include adequate water quality and quantity, and habitat features to support foraging and refuge during rearing and migration.

The main stem Yakima River including both reaches supports several priority fish species (see Table 5). Reach 2 is dominated by wetland habitat considered a priority habitat in the State of Washington (WDFW 2008) due to their overall functions and values. Freshwater streams and riparian areas (where aquatic and terrestrial environments interact to influence each other) are also considered priority habitats for their unique environment and important role for fish and other wildlife. Riparian buffers have been affected by altered vegetation structure (developed open space) in the floodplain in Reach 2. Riparian vegetation in Reach 1 appears intact based on aerial imagery and land cover. It is comprised primarily of scrub-shrub vegetation, and small wetlands are likely present along the shoreline at least intermittently.

Shoreline Modifications

Based on aerial images, modified bank structure is apparent in Reach 1 at the McWhorter irrigation canal. Shoreline modifications are not apparent in the other reaches. However, there is a levee located south of the Van Giesen Street Bridge (Reach 2) that continues south outside of the study area (see Figure 1.2 in Appendix A). There is also an outfall north of the wastewater treatment plant in Reach 2 with an armored bank that extends approximately 100 feet upstream and 100 feet downstream from the outfall.

Channel migration is a concern with any shoreline. As a consequence of their differing topographic contexts, the reaches delineated for the study area differ in their exposure to channel migration. Reach 1 is not subject to substantial risk of channel migration, while Reach 2 is in a channel migration zone.

Water Quality

In Reach 1, a segment of the stream within Township 10 North, Range 27 East, Section 16, is identified in the Washington Department of Ecology 303(d) list as impaired (Category 5) due to 4,4'-DDE. Pollutant levels exceeded the National Toxics Rule criterion in four out of four samples collected in 1995 (Ecology 2012c). The reach may be affected by this non-point source pollutant based on topography, land use, and local hydrological patterns.

Reach 2 is listed on Ecology's 303(d) list for Category 5 impairments for dissolved oxygen and pH. In 2003 and 2004, the water quality criterion for dissolved oxygen (8.0 mg/L) was exceeded in 42 percent and 33 percent of the samples in each year respectively. Similarly, Reach 2 is listed as impaired for pH based on 20 percent and 22 percent of the samples exceeding the criterion in 2003 and 2004 respectively (Ecology 2012c).

Public Access Structures

There are currently no improved water access facilities in the study area. An unpaved private road crosses the floodplain from water treatment facility in Reach 2, to a small cleared area, and for approximately 800 feet along the Yakima River.

Functional Assessment

Table 10 summarizes the functional assessment of the reaches based on the methods described previously and information identified and reviewed for the inventory and characterization.

Table 10. Reach-scale Functional Assessment.

	Function	Reach 1: Yakima River West	Reach 2: Yakima River East
Hydrologic	Transport of water and sediment	MODERATE	MODERATE
	Attenuation of flow energy	MODERATE	HIGH
	Developing pools, riffles, gravel bars, nutrient flux, recruitment and transport of large woody debris and other organic material	LOW	HIGH
Vegetation	Maintaining Temperature	LOW	LOW
	Removing excessive nutrients and toxic compound	LOW	LOW
	Sediment removal and stabilization	MODERATE	MODERATE
	Attenuation of high stream flow energy	LOW	HIGH
	Provision of recruitable woody debris and other organic material	LOW	LOW
Hyporheic	Water storage, sediment storage, maintaining base flows, and removing excessive nutrients and toxic compound	MODERATE	MODERATE
	Support of vegetation	LOW	MODERATE
Habitat	Physical space and conditions to support water-dependent species and life history stages; reproduction; resting, hiding and migration; and food production and delivery	MODERATE	MODERATE
Total Score [a]		**16**	**22**

[a] To determine total score for each reach, low=1, medium=2, high=3 and scores are added.

Based on the rating of the function (low to high), a numerical number was applied to each function (low=1, medium=2, high=3) to arrive at a total score for each reach. Reach 2

has the highest score (22) based on the ratings of functions, and has a moderate level of development, indicating that this reach may be suitable for restoration. Future development may be focused in areas already disturbed or impacted by development such as adjacent roads and infrastructure. Less disturbed areas may be considered for protection given the relatively high score.

Reach 1 has a lower total score (16). Although this reach has a low function score, development is currently lacking, and thus would suggest restoration or protection strategies would be appropriate for future management. However, the relatively low function score is probably comparable to natural, historical conditions and the historical potential to provide functions related to water quality, water quantity, and habitat. Because the low function score is the result of naturally lower potential for the reach to provide functions, and not the result of anthropogenic impacts or disturbances, restoration opportunities may be limited to programmatic actions that improve water quality and water quantity, or serve to protect functions from future impairment.

Restoration Opportunities / Special Management Considerations

The study area is within the Middle Columbia River steelhead recovery unit and managed under the 2009 Yakima Subbasin Salmon Recovery plan. The plan calls for basin-wide actions and lower main stem actions related to reservoir operations, screening water diversions, increasing on-farm irrigation and water delivery efficiency, improving recruitment of cottonwoods, and improving the river's hydrograph through artificial storage and Columbia River water transfers, among others.

The US Bureau of Reclamation and Ecology convened the Yakima River Basin Water Enhancement Project (YRBWEP) Workgroup in 2009 to develop a recommendation for advancing a Yakima Basin preliminary Integrated Water Resource Management Plan (IWRMP) to restore fisheries and improve water supply in the Yakima River basin, including the study area (YRBWEP 2009). The workgroup continued to develop the plan through 2011 and in 2012 the integrated plan was selected as the preferred alternative in the Final Programmatic Environmental Impact Statement (USDI 2012). A 26-mile reach of the lower Yakima River from Prosser to its mouth, including the study area, was identified as a Tier III restoration reach, the lowest of a three-tier rating (YRBWEP 2009 and 2011). The reach was classified as Tier III based on the timing and schedule of restoration efforts which, for Tier III, includes "program flexibility because some projects could be scheduled later depending on priorities, readiness to proceed, and new information developed over time". The study recommended improvements for the 26-mile reach, including the following:

- Connect wetlands with the river
- Restore 1 mile of riparian habitat
- Improve in-stream habitat complexity (e.g., logjams)
- Protect 400 acres through conservation easements and acquisitions

Recommended restoration actions more specifically included installation of engineered log jams and protection of floodplain and riparian lands through property easements and acquisitions. Similar restoration actions were identified by the Benton County Conservation District (BCD) for the lower Yakima River, West Richland area, and study area in an assessment of the lower Yakima River in Benton County (BCD 2011).

Opportunities for restoration in the Yakima River basin in general include restoring side channel and off-channel habitats that provide thermal refugia, as these habitats have been reduced from historical conditions. However, potential sites for side channel and off-channel habitat restoration were not identified in the study area during the preparation of this inventory and characterization. Restoration of priority fish habitat might include monitoring and control efforts for nuisance-level water stargrass on a watershed or site-specific scale. Shoreline functions related to hydraulic, hyporheic, vegetation, and physical processes that affect habitat might also be improved through acquisition of agricultural land for developing wetlands, or by restoring floodplain wetlands where they are still connected to the Yakima River (Reach 2). However, as described previously for Reach 1, site-specific opportunities for restoration are likely limited due to existing undeveloped conditions. Opportunities may also be constrained by regional water management and dam operations such as those outlined and described in the Interim Comprehensive Basin Operating Plan (USBR 2002). Therefore, programmatic and regulatory actions that improve or protect water quality and water quantity may be restoration actions most suitable for the action area.

In the last decade, the quality of return flows in the lower Yakima River has improved dramatically, with an approximate 90 percent decrease in turbidity due to improved irrigation management and implementation of the sediment TMDL for the lower Yakima River (Conley et al. 2009). Water quality monitoring and continued programmatic or site specific actions could continue to improve water quality which is currently impaired in the study area. Monitoring and ecological studies may also help to understand and respond to ecological changes that are occurring as a result of water management practices (Wise et al. 2009).

A formal restoration plan will be prepared in a later phase of the SMP process and contain specific projects that conform to the general characteristics of projects and plans described above.

Shoreline Use Analysis

Examining land use patterns and existing public access opportunities are important considerations in the SMP analysis because such examinations can identify opportunities for preferred uses, especially water-dependent, water-oriented and water-enjoyment uses. Land uses adjacent to the water are also a determinant in assigning environment designations to specific sections of the shoreline. Additionally, an analysis of land use conditions is necessary to determine potential land use changes and their effect on shorelines with respect to SMA objectives. The proposed environment designation boundaries and provisions must be mutually consistent with the City's Comprehensive Plan.

Existing Land Use Patterns

Reach 1 is currently undeveloped and consists primarily of upland shrub/scrub range land. Irrigated agriculture occurs in the vicinity of Reach 1 outside the shoreline jurisdiction, which, although unregulated by the SMA, may influence the current and future conditions of the shoreline due to the wide ranging effects of land use.

Reach 2 is more developed than Reach 1, containing several single-family residential parcels, medium density commercial development around the Van Giesen Bridge, portions of a recreational vehicle park, and the West Richland Golf Course. The golf course and the open space surrounding the wastewater treatment plant account for the majority of the reach's acreage.

Projected Land Use Patterns

Zoning in Reach 1 consists of either Low Density Residential (40 acres) or Public Parks and Recreation. Almost all of the land within Reach 1 is under common ownership. Low Density Residential zoning would allow large-lot residential development to occur in currently undeveloped portions of Reach 1 along the Yakima River. However, given that the shorelands of Reach 1 are under common ownership with a large agriculture operation to the east and that the minimum lot size required by the RL-40 zoning would allow for relatively few residences, significant redevelopment of Reach 1 may not occur in the foreseeable future.

Reach 2 consists mostly of Agriculture and Public Parks and Recreation zoning. Public Parks and Recreation zoning is applied to the West Richland Golf Course, and Agriculture zoning is applied to surrounding privately owned open space. While Reach 2 also contains parcels zoned Commercial Use, Multifamily Residential 3, Public Capital Facilities, Low Density Residential (22 acres), and Medium Density Residential (10 units per acre), these account for less than 10 percent of the reach's total acreage and are the most intensely developed portions of the shoreline jurisdiction, leaving a relatively low potential for additional commercial or residential development. The large, relatively undeveloped areas of Reach 2 are zoned for agricultural use or public recreation, and require changes to adopted zoning in order to experience significant levels of development.

Public Shoreline Access

There is currently limited public shoreline access to the Yakima River. On the City's easternmost edge, Fallon Drive and the Van Giesen Bridge provide visual access to the Yakima River. The City's Parks and Recreation Plan found that improved access to the Yakima River was a major priority, but there are valid concerns among neighbors and residents along or near the river regarding traffic, litter, and disrespectful behavior of the public.

Access to the Yakima River is a major priority and value for the City's residents. Currently there is only one location in the City in which the public can access the river. It is located on a privately owned site near the Van Giesen Bridge; the location is small, congested, and features multiple user challenges and neighbor issues.

The Parks and Recreation Plans recommends developing a river access park with limited or no structures that would be susceptible to flooding, is properly located for safety and security enforcement, and can be managed to ensure respect of neighbor's property owner rights. Potential locations for this park could include, but not be limited to Fox Island or upstream of the golf course. Other possible sites for this park could be on the northern boundaries of the City along the river.

The City would like to redevelop and maintain a natural surface trail along the Yakima River at the Golf Course and north, which connects to a paved pathway along Fallon Drive extending to the Van Giesen and Bombing Range Road intersection.

The City's Parks and Recreation Plan identified two visionary projects along the Yakima River. The Lewis and Clark Trailway would loop up to the Yakima River along Reach 1. Another project would be a whitewater park along the Yakima River that utilizes the river as a water source. It would require extensive technical and feasibility study and permitting from the US Army Corps of Engineers and any applicable state and local regulatory agencies. According to the Parks and Recreation Plan, the nature of the Yakima River in this region would suggest the best whitewater course would be a constructed diversion channel of at least 2,000 feet in length, and an average width of 30 to 50 feet. If a suitable site were located, it was recommended that a whitewater park be developed in concert with mixed use and retail development, and even possibly limited residential development.

Identification of Potential Conflicts and Effects on Ecological Function

Based on a review of adopted zoning, very little potential exists for development that would conflict with the policies of the SMA. Most of the areas with development potential within the shoreline jurisdiction are zoned for residential and recreational uses, which are considered preferred under SMA, or for agricultural use. The City's shoreline jurisdiction contains no areas zoned for industrial use and less than 2 acres zoned for commercial use around the West Van Giesen Road (SR 224) bridge.

While there is limited potential for conflict with the policies of the SMA, the City must also ensure that permitted development within the shoreline jurisdiction does not result in ecological harm. Without proper regulation, residential and agricultural operations can generate runoff that degrades water quality or result in shoreline modifications that reduce ecological functions.

Data Gaps

This section describes key data gaps that were identified during the shoreline inventory and characterization.

Geological Maps

High quality geological maps showing accurate topography for the City's jurisdiction were not available. Available geological maps of 1:24,000 scale are of generally poor quality and outdated. Updated geologic maps based on recent lidar data would provide improved

topography that would assist in identifying areas of past land modifications as well as future restoration opportunities.

Shoreline Modifications

A comprehensive inventory of shoreline modifications was not available for the study area. Detailed information regarding shoreline modifications such as bank armoring, water diversion inlets and outlets, and other areas of altered bank or bed conditions could be collected and compiled into a georeferenced database. This information could then be used to make informed decisions on protection and restoration opportunities along the shorelines. Similarly, a survey of habitat features such LWD, substrate types, and riparian vegetation could inform site-specific management decisions for protection, restoration, and enhancement activities.

Nuisance and Invasive Vegetation

No formal surveys or monitoring of water stargrass in the City's jurisdiction were identified. Local growth patterns, and habitat preferences and limitations for this native species are not clearly understood, although observations indicate the plant is suited to a broad range of ambient light and substrate conditions (R. Little, BCD, personal communication, March 7, 2013), and it is common throughout the lower Yakima River (below RM 47), which includes the City's shorelines. A survey and ongoing monitoring program would help determine the need for control of nuisance-level growth. Formal monitoring would provide an opportunity to identify and evaluate the extent to which shoreline uses are impacted, and whether control of the plant in a specific location would be beneficial. A monitoring program would also provide an opportunity to identify existing and future occurrences of flowering rush or other invasive aquatic and riparian species in the SMA jurisdiction.

Water Quality

Water quality has been monitored in numerous locations throughout the Yakima River basin. Although there have been significant improvements in water quality over the past several decades, which are attributed, at least in part, to the development of TMDLs and improved agricultural practices, water quality in the region continues to be a focus for numerous agencies. Water quality impairments in the study area were documented in 1995 in Reach 1, and in 2003 and 2004 in Reach 2. Frequent and long term water quality monitoring throughout the SMA jurisdiction could provide more current data, and a more complete picture of overall water quality conditions. More current data could be used to develop appropriate recommended best management practices as well as strategies for protection and restoration. Monitoring would also provide a baseline for evaluating the success of water quality improvement activities in the future.

Climate Change

While there is an increasing volume of research around climate change in Washington (Adams et al. 2010; Ecology 2012d; Hamlet et al. 2010), the implications of climate change on a local scale in terms of future shoreline and water-oriented uses are not yet clearly understood. As snow pack is reduced and rainfall events are increased by climate change, dynamic factors

such as available water storage in soils and water management practices, in addition to local topography, will produce changes in stream flow patterns and potentially impact water available for use. Considering additional research as it becomes available, and involvement in state and watershed level planning efforts to address climate change, will help inform local shoreline management decisions over the long term such as the next 20 to 100 years.

Environment Designations

For areas under SMA jurisdiction, the intent of shoreline environment designations is to encourage uses that will protect or enhance the current or desired character of a shoreline. WAC 173-26-211(2)(a) requires that SMPs classify all shoreline areas into specific environment designations based on "existing use pattern, the biological and physical character of the shoreline, and the goals and aspirations of the community as expressed through comprehensive plans…"

For urban areas, the SMP Guidelines recommend using the five environment designations below. The purposes are defined in WAC 173-26-211(5).

1. **High Intensity** - The purpose of the High Intensity environment is to provide for high intensity water-oriented commercial, transportation, and industrial uses while protecting existing ecological functions and restoring ecological functions in areas that have been previously degraded.

2. **Shoreline Residential** - The purpose of the Shoreline Residential environment is to accommodate residential development and appurtenant structures that are consistent with this chapter. An additional purpose is to provide appropriate public access and recreational uses.

3. **Urban Conservancy** - The purpose of the Urban Conservancy environment is to protect and restore ecological functions of open space, floodplain and other sensitive lands where they exist in urban and developed settings, while allowing a variety of compatible uses.

4. **Natural** - The purpose of the Natural environment is to protect those shoreline areas that are relatively free of human influence or that include intact or minimally degraded shoreline functions intolerant of human use. These systems require that only very low intensity uses be allowed in order to maintain the ecological functions and ecosystem-wide processes. Consistent with the policies of the designation, local government should include planning for restoration of degraded shorelines within this environment.

5. **Aquatic** - The purpose of the Aquatic environment is to protect, restore, and manage the unique characteristics and resources of the areas waterward of the OHWM.

Once each environment designation is established, management policies and regulations specific to the environmental designations will be prepared as part of Phase 3 of the SMP. The management policies and regulations will reflect the purpose and intent of each environment designation.

These policies and regulations will apply to all uses allowed within each environment designation. They establish what kind of uses will be permitted outright, need a shoreline conditional use permit, or are prohibited in that part of the shoreline jurisdiction. They also establish bulk and dimensional regulations for each environmental designation. Similar to a zoning code, these regulations can include maximum heights, setbacks, maximum lot coverage, maximum impervious surface coverage, as well as specific regulations that, for example, address site development, vegetation, and public access.

Environment designations proposed for West Richland shorelines are shown in Figures 9.1 and 9.2 in Appendix A. For all portions of the City's shoreline jurisdiction, lands that are waterward of the OHWM are designated Aquatic. Other proposed shoreline environment designations, including the criteria used to determine the designation based on SMP Guidelines in WAC 173-26-211(2)(a), are described for various portions of the shoreline jurisdiction in the sections below.

Reach 1 – Yakima River West

Urban Conservancy

Criteria for determining the proposed environment designation for Reach 1 (Urban Conservancy) include the following:

1. The existing land use pattern is primarily natural open space with small areas of developed open space.
2. In its undeveloped state, the shoreline reach's biological and physical character indicate that limited functions are present, but the reach provides habitat functions that can be protected. Restoration or potentially protection would be appropriate throughout the reach.
3. The Comprehensive Plan designations for the reach are:
    a. **Low Density Residential** - Single-family residential development with a density range of two or less dwelling units per acre
    b. **Public Reserve** - Lands set aside for public use, including parks, critical areas, canals, waterways, and public buildings
4. The adopted zoning districts in the reach are:
    a. **Low Density Residential 40** - Low Density Residential districts serve to protect steep slopes from over-development or otherwise address environmental constraints. The districts are also applied to areas where provision of full urban services is unlikely to occur due to existing development patterns and topographical restraints.
    b. **Public Parks and Recreation** – These are reserve lands for public uses such as recreation, utility facilities, open space, and environmental protection.

5. Specific designation criteria in WAC 173-26-211(5)(e)(iii): Assign an Urban Conservancy environment designation to shoreline areas appropriate for and planned for development that is compatible with maintaining or restoring the ecological functions of the area, that are not generally suitable for water-dependent uses and that lie in incorporated municipalities if any of the following characteristics apply:

    a. They are suitable for water-related or water-enjoyment uses

    b. They are open space, floodplain or other sensitive areas that should not be more intensively developed

    c. They have potential for ecological restoration

    d. They retain important ecological functions, even though partially developed

    e. They have the potential for development that is compatible with ecological restoration

Reach 2 – Yakima River East

Environment designations in Reach 2 are more diverse than in Reach 1. The environment designations are not necessarily applied to an entire shoreline segment (Areas 2a through 2d). Instead, the environmental designation is applied to a geographic area with similar local conditions (e.g., land use and zoning) which are used to support the designation.

The following four areas were identified based on their unique sets of criteria, described in the sections below.

- Urban Conservancy (Area 2c and Area 2d)
- Shoreline Residential (South of the Van Giesen Bridge in Area 2a and Area 2b)
- High Intensity (approximately North of the Van Giesen Bridge and West of Butte Court in Area 2a)
- Urban Conservancy (approximately North of Fallon Drive and East of Butte Court in Area 2a)

Urban Conservancy (Areas 2c and 2d)

Criteria for determining the proposed environment designation for areas 2c and 2d in Reach 2 include the following:

1. The existing land use pattern is primarily agricultural with natural open space.
2. Wetlands are identified throughout most of the reach except where altered by road. The functions of lake and associated wetland should be restored and protected. Buffers should be protected from future development.
3. The Comprehensive Plan Designations for the reach are:

a. **Public Reserve** - See the designation description under Reach 1

b. **Medium Density Residential** - Single or multi-family residential development with a maximum unit density range of nine dwelling units per acre

4. The adopted zoning districts in the reach are:

   a. **Medium Density Residential 6** - Single-family and two-family medium density residential areas

   b. **Medium Density Residential 12** - Single-family and two-family residential areas of medium density

   c. **Low Density Residential 40** - See the district description under Reach 1

5. See the specific designation criteria for Urban Conservancy under Reach 1.

Shoreline Residential (South of the Van Giesen Bridge in Area 2a and Area 2b)

Criteria for determining the proposed environment designation for this portion of Reach 2 include the following:

1. The existing land use pattern is primarily single family residential.

2. Area is built out with single-family development with limited ecological function. There is a levee in portion of reach.

3. The Comprehensive Plan Designations for the reach are:

   a. **Medium Density Residential** - See the designation description under Areas 2c and 2d

   b. **Public Reserve** - See the designation description under Reach 1

4. The adopted zoning districts in the reach are:

   a. **Medium Density Residential 10** - Single-family and two-family residential areas of medium density

   b. **Public Capital Facilities** - Lands set aside for public use, including parks, schools, and public buildings

5. Specific designation criteria in WAC 173-26-211(5)(e)(iii): Assign a Shoreline Residential environment designation to shoreline areas inside incorporated municipalities if they are predominantly single-family or multifamily residential development or are planned and platted for residential development.

High Intensity (Approximately North of the Van Giesen Bridge and West of Butte Court in Area 2a)

Criteria for determining the proposed environment designation for this portion of Reach 2 include the following:

1. The existing land use pattern is a mixture of commercial and single family development

2. Built out with limited ecological function

3. The Comprehensive Plan Designations for the reach are:

    a. **Commercial** - Includes a variety of retail, wholesale, and office uses. Many of these areas also contain residential to meet the goals of the community, provide mixed use, lower travel times, and provide future residents with a larger variety of housing choices.

    b. **Public Reserve** - See the designation description under Reach 1

4. The adopted zoning districts in the reach are:

    a. **Multi-Family Residential 3** - Areas permitting a greater dwelling density than is allowed in more restrictive residential classifications, while protecting against hazards, objectionable influences, building congestion, and lack of light, air and privacy. The district may be utilized as a transition between lower-density residential and commercial classifications.

    b. **Neighborhood Business** - Provides for small commercial and service businesses to serve the needs of the surrounding neighborhood

    c. **Public Parks and Recreation** - See the designation description under Reach 1

5. Specific designation criteria in WAC 173-26-211(5)(e)(iii): Assign a High Intensity environment designation to shoreline areas within incorporated municipalities if they currently support high-intensity uses related to commerce, transportation or navigation; or are suitable and planned for high-intensity water-oriented uses.

Urban Conservancy (Approximately North of Fallon Drive and East of Butte Court in Area 2a)

Criteria for determining the proposed environment designation for this portion of Reach 2 include the following:

1. The existing land use pattern is primarily agricultural and developed open space (golf course) with the wastewater treatment plant and one single-family residence.

2. Floodplain and floodway present in much of the area. The area flooded in 1996, even outside of the designated floodplain and floodway. A levee is in a portion of the reach. High-risk area would not be suitable for more intense development. Future development may be focused in areas already impacted by development such as adjacent roads and infrastructure. Less disturbed areas without roads and structures provide opportunities for protection.

3. The Comprehensive Plan Designations for the reach are:

    a. **Low Density Residential** - See the designation description under Reach 1

b. **Public Reserve** - See the designation description under Reach 1

4. The adopted zoning districts in the reach are:

   a. **Agriculture** – The Agriculture District permits essential agricultural and horticultural uses of land. The district includes both active agricultural lands and lands unsuitable for long-term agricultural use. The classification is applied only to outlying rural and undeveloped areas that were annexed before the 1990 Growth Management Act. Generally, these areas are far from urban services and the existing developed areas of the city. Some areas of this zone are also limited by environmental constraints, such as floodplains, steep slopes, and wetlands.

   b. **Low Density Residential 22** – Low Density Residential districts serve to protect steep slopes from over-development or otherwise address environmental constraints. The districts are also applied to areas where provision of full urban services is unlikely to occur due to existing development patterns and topographical restraints.

   c. **Public Parks and Recreation** - See the district description under Reach 1

5. See the specific designation criteria for Urban Conservancy under Reach 1.

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